



# NANOMATERIALS TECHNOLOGY

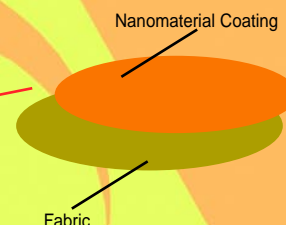
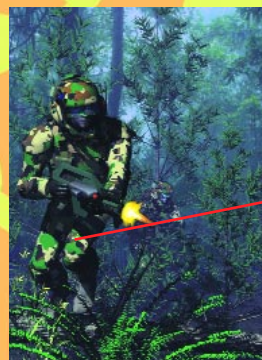


Hostile use of chemical and biological warfare agents against U.S. forces is a serious threat. Chemical and biological warfare agents are relatively inexpensive, readily accessible, and easily concealed. The threat is amplified by the proliferation of nations as well as terrorist groups capable of obtaining and using these agents. Providing our soldiers with physical protection and other means of surviving these threats requires the development and application of advanced technology.

The U.S. Army Research Laboratory (ARL) and the U.S. Army Soldier and Biological/Chemical Command (SBCCOM) are developing nanomaterials technology that can provide significant enhancements to chemical and biological defense. Nanomaterials, such as dendritic polymers, represent a breakthrough technology that provides a means of making emerging concepts and systems more practical and affordable, including individual protective equipment, detection systems, and decontamination.

## Ultralight Soldier Protective Clothing

The direct application of nanomaterials to the soldier's clothing has the potential of providing a low-cost, lightweight, and flexible alternative to the current heavy, charcoal-based protective suit. Through a simple coating process, very thin layers of enzyme-based nanocapsules and polymer-based nanoreactors have been coated onto a variety of fabrics including cotton, nylon, and the fabric used for the current Battle Dress Uniform (BDU). The resulting protective clothing is very light and flexible to wear and can be washed and recoated repeatedly.

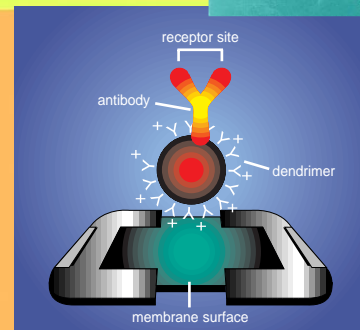
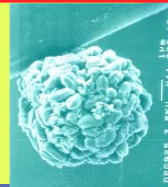


## Chemical/Biological Agent Detection

ARL and SBCCOM are developing an improved handheld device that features a nanomaterial, called a dendrimer, that can reliably detect the presence of biological warfare agents at extremely low concentrations. This technology can be applied to the Hand-Held Immunochromatographic Assay, currently being fielded to joint-service troops, and can help streamline the application of advanced critical reagents such as recombinant antibodies.

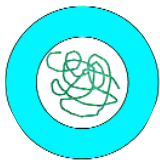


Bio-Agent  
Micrograph Image  
(Anthrax Spore)

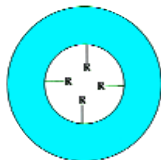


# CHEMICAL/BIOLOGICAL DECONTAMINATION

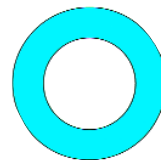
## *Universal Chem/Bio Decon Solutions*



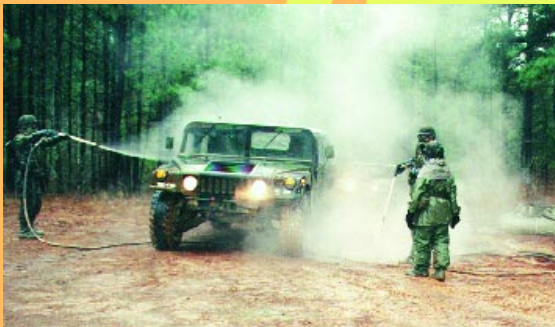
Nanocapsulations



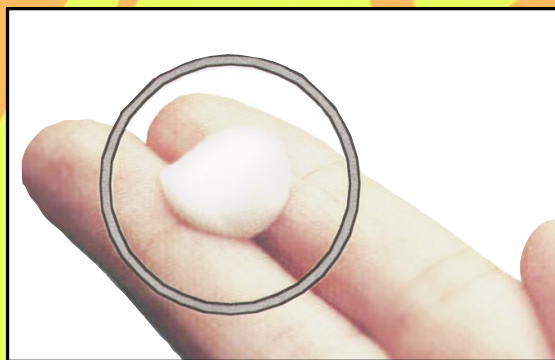
Nanoreactors



Nanoemulsions



Based on our previous results, mild, non-toxic formulations (solid or solution phase) are being developed for decontaminating both chem- and bio-threat agents. The chem-decon formulations, potential replacements for DS2, are being tested at Dugway Proving Ground. The oil-based, bio-decon nanoemulsions have already been tested by the U.S. Army Medical Research Institute for Infectious Diseases and proved to be effective for a variety of bio-threat agents such as anthrax spores, bacteria, and envelope viruses.



## *Reactive Topical Skin Protectant*

Enzyme-based nanocapsules and polymer-based nanoreactors can be conveniently formulated into the current topical skin protection creams. Such creams not only exhibit protection properties, but also possess active decontamination capabilities. ARL is supporting the U.S. Army Medical Research Institute for Chemical Defense in the Reactive Topical Skin Protectant Program.

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